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Is Public Health – Dayton & Montgomery County's Level One Food Safety Certification  
Training Effective?

Matthew M. Tyler

Wright State University

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### **Abstract**

The objective of the culminating experience was to evaluate the effectiveness of Public Health – Dayton & Montgomery County's (PHDMC) Level One Food Safety Certification class. Pre-training and post-training quiz score data from approximately 692 participants were examined. Paired t-tests were used to evaluate change in scores, overall, on individual questions, and by job responsibility. There was significant improvements in quiz scores both aggregately (20.6%) and also by individual questions, except for question one which assessed how people could become ill from improper food safety. The temperature related questions were answered incorrectly the most but also showed the most improvement. Owners of food service operations had the highest mean pre-training quiz scores (82.0%) but restaurant servers had the highest mean post-training scores (96.9%) and showed the most improvement (20.0%). This culminating experience has shown that PHDMCs Level One Food Safety Certification class was effective in increasing of participants from pre to post training.

*Keywords:* Food Safety; Training; Certification; Public Health; Knowledge

### **Is Public Health - Dayton & Montgomery County's Level One Food Safety Certification Training Effective?**

Food safety training is an important tool in preventing foodborne illness (Soares, Garcia-Diez, Esteves, Oliveira, & Sariva, 2013). It gives those working in the food service industry the knowledge and skills necessary to properly handle, cook and serve food. The training comes in many forms but generally consists of classroom-type instruction, some practical hands-on application of the knowledge learned, or both. One can receive the training at their place of work, from their health department, if it is offered, or from a private organization. Some training ends with certification, which is either permanent or in need of renewal, depending on the state and or local requirements. Some states also make it mandatory for either food managers or food handlers to carry food safety training certification (TrainandCert.com, 2011). In Ohio, Level One Certification in Food Protection training, as mandated by the Ohio Department of Health (ODH) is a basic two-hour course and can be a written or verbal exercise. It is mandatory if an establishment has been implicated in a foodborne disease outbreak or when they have failed to maintain sanitary conditions. It is also mandatory for one person in charge per shift of new food service operations or new retail food establishments licensed after March 1, 2010 unless they have received other equivalent certification. Once completed, Level One Food Safety Certification in Ohio does not have an expiration date.

Beginning in 2011, local health departments in Ohio were allowed, by ODH, to teach a level one food safety course. Sanitarians at Public Health - Dayton & Montgomery County (PHDMC) in Dayton, Ohio, teach this food safety training course once a month and as requested. This two-hour basic food safety training course is meant for food service or retail food establishment employees including owners, managers and persons in charge, but is open to the

public as well. The course teaches food safety topics such as hand washing, duties of the person in charge, employee hygiene, correct cooking and holding temperatures and sanitization, among others. The participants are offered a quiz at the beginning of the course and the same quiz is offered after completion of two hours of training. The completion certificate is recognized throughout the state of Ohio.

### **Statement of Purpose**

This culminating experience will evaluate PHDMC's Level One Food Safety Certification training course by looking pre- and post-quiz scores. The scores, before and after the training, were compared to assess its effectiveness in changing the knowledge of the participants. The changes in scores for the individual questions were analyzed to see which questions were missed the most. Further, a relationship among quiz scores and primary job responsibility of the food service worker were assessed.

### **Review of Literature**

#### **Global Burden of Foodborne Illness**

Foodborne illness (FBI) is a public health issue that affects all countries worldwide (Soares et al., 2013; World Health Organization [WHO], 2014). Globalization is leading to an ever more interconnected world. Both the increase of international travel and global trade in food around the world, is leading to an increased burden of FBI. International travel was projected to increase 48% from 2000 to 2012 to one billion travelers per year (Harvey et al., 2013). Travelers from more developed countries, when visiting less advanced parts of the world, are exposed to poor sanitation, unsafe food sanitation practices and endemic diseases not normally encountered in their countries of origin. This facilitates exposure to foodborne pathogens, and results in travel-related illness or travelers' diarrhea. But even non-travelers are

more at risk from contracting a FBI at home, as food imports from other countries increase. The United States (U.S.) has one of the most diverse food supplies globally, as it can afford to import food from all over the world during all times of the year. Between 2005 and 2010, 39 outbreaks (1.5 % of total outbreaks) were associated with imported food in the U.S. (McEntire, 2013). As globalization occurs and travel-related FBIs and food imports increase, so will the rates of FBI.

Both developed and developing countries experience FBI but developing countries sustain a heavier burden. Diseases resulting from food and water are major causes of morbidity and mortality, especially children, around the world and the leading cause of death in developing countries. An estimated 1.9 million children die each year from diarrheal diseases mostly attributable to foodborne illness (WHO, 2014). Even in the U.S., preliminary 2013 data suggests that children under five years old sustained higher incidence rates for most foodborne infections (Crim et al., 2014).

Estimates of the burden of FBI are needed to show the extent of the problem but these estimates are difficult to ascertain for a number of reasons. A FBI must first be identified. For this to happen, a person must seek out medical care and be tested to confirm causative pathogen. Many countries do not have adequate medical care, disease surveillance systems or even reporting requirements. Most people only seek out medical care for a severe FBI, so many illnesses go unreported. Also, the risk differs across parts of the world due to the varying data collection practices, economic constraints and regulatory efforts. Therefore, global estimates are virtually impossible to ascertain (McEntire, 2013). The WHO has begun an effort to estimate the global burden of FBI through an initiative, the Foodborne Disease Burden Epidemiology Reference Group (FERG). The FERG initiative has not compiled the data yet, but initial



findings suggest the burden is three times higher than previously thought (McEntire, 2013; WHO, 2014).

Food safety practices can vary widely, even among different businesses on the same street in one city, let alone in different countries. Each manager, owner, business and corporation needs to ensure all their employees are properly trained in food safety and understand the relationship between food safety and disease prevention. Many studies have been conducted to explore knowledge and practices of food safety in other countries. A study in Saudi Arabia showed good knowledge of pathogens among sanitarians (Al Dagal, 2003), but a Malaysian study showed poor knowledge of temperature control among food handlers (Zain & Naing, 2002). Two studies in Italy found inadequate knowledge among food handlers and a need for more interventions in training (Panchal, Carli, & Dworkin, 2014; Grappasonni et al., 2013). Kibret and Abera (2012) reported good knowledge of food hygiene but poor practice of food safety by food handlers in a city in Ethiopia. Isara and Isah (2009) reported both good knowledge and practices by food handlers in a city in Nigeria. Overall, literature regarding food knowledge and practices in other countries provided mixed results.

A number of international studies showed food safety training improves knowledge (Laverack, 1989; Howes, McEwan, Griffiths, & Harris, 1996; Nabali, Bryan, Ibrahim, & Atrash, 1986; Reicks, Bosch, Herman & Krinke, 1994). However, an increase in knowledge does not necessarily translate into behavior change; interventions and training need to focus on this aspect (Kibret & Abera, 2012; Oteri & Ekanem, 1989; Pilling, Brannon, Shanklin, Howells, & Roberts, 2008; Redmond & Griffith, 2003; Rowell, Binkley, Thompson, Burris, & Alvarado, 2013).

### **National and State of Ohio Burden of Foodborne Illness**

On a national scale, FBI estimates are much easier to compile if reporting and surveillance systems are in place, as practiced in most of the developed countries. The U.S. has allocated resources and government agencies to regulate, prevent, investigate and report FBI. However, even in the U.S., it is estimated that every year 48 million people fall ill, 128,000 are hospitalized and 3,000 die due to FBI (Centers for Disease Control and Prevention [CDC], 2011). FBI, associated hospitalizations and deaths estimated costs are between \$10 and \$38 billion in the U.S (Pilling et al., 2008). Even with sufficient resources, FBI still occurs and is costly.

During 2012 in Ohio, there were 427 disease outbreaks in 64 out of the 88 counties (ODH, 2012). Eighty-five of these outbreaks were foodborne and 43 of those 85 were confirmed through laboratory testing. The causative agents were *Campylobacter* spp. (5), *Clostridium perfringens* (2), *E. coli* O26 (1), *E. coli* O45 (1), *E. coli* O157:H7 (2), *Listeria monocytogenes* (1), Norovirus GI (4), Norovirus GII (21), *Salmonella* spp. (4) and *Vibrio parahaemolyticus* (2). The overwhelming causative foodborne illness agent in 2012 was Norovirus, causing 58% of the outbreaks (ODH, 2012). The 43 confirmed outbreaks occurred in the following events or settings: commercial products (8), banquets (6), restaurants (8), retreat (1), catered meal at home, school or work (7), takeout meals (5), church meal (2), private home (2), picnic (2), school trip (1) and street fair (1). Around 743 people fell ill from these 43 confirmed outbreaks. Due to underreporting, it is difficult to know the true number of illnesses and outbreaks that occurred (ODH, 2012).

**Factors associated with Foodborne Illness**

The knowledge and practice of using critical violations are commonly assessed in food safety studies and evaluations of food safety knowledge and practice (Burke, Manes, Liu, & Dworkin, 2014; Cotterchio, Gunn, Coffill, Tormey, & Barry, 1998; Kassa, Silverman, & Baroudi, 2010; Lynch, Elledge, Griffith, & Boatright, 2005; Pilling et al., 2008; Rowell et al., 2013). These significant factors, termed critical violations, such as but not limited to temperature abuse, personal hygiene and cross contamination are most closely linked to FBI (Kassa et al., 2010; Pilling et al., 2008; Soon, Baines, & Seaman, 2012). Time and temperature abuse involves not keeping food at the proper hot or cold temperatures. This abuse allows bacteria to grow to dangerous levels. Personal hygiene consists of proper hand washing, clean attire and anything that would prevent food being contaminated by viruses or bacteria on the person. Cross contamination implies contact between contaminated (bacteria, viruses and allergens) by items that can taint other foods or surfaces. Other critical violations include approved food sources and cleaning and sanitizing of food contact surfaces (Ohio Administrative Code [OAC] 3701-1, 2009). Worker knowledge, attitudes and behaviors regarding these concepts contribute to how food is handled, prepared and served.

**Role of Training and Certification in FBI Prevention**

Food safety training for workers is one method to improve food safety practices throughout the industry. There have been numerous studies on the effectiveness of food safety training concerning knowledge, attitudes and behavior of food safety workers. Effective training is important, primarily, to help keep consumers healthy, and secondarily, to keep costs of both time and money low. There are a number of different types of training from basic classroom instruction, watching video or picture demonstrations, to interactive on-the-job trainings.

There are some benefits from food safety training, including improvement in knowledge or written test scores, or having less critical violations during inspections. Participant's change in test scores range from negligible (Egan et al., 2006) or moderate to significant improvement (Cotterchio et al., 1998; Kassa et al., 2010; Soon et al., 2012). Lynch, Elledge, Griffith, and Boatright (2003) found significant differences in mean test scores between trained (88.5) and untrained (79.5) participants ( $p$ -value = 0.0129). Kassa, Silverman, and Baroudi (2010) reported 1.75 critical violations in establishments with certified personnel versus 2.08 critical violations in establishments without certified personnel ( $p$ -value: 0.040).

However, Egan et al. (2006) reported that increases in knowledge and test scores may be short lived. When food employees are followed after a period of time after training, test scores and knowledge in food safety practices decreased starting after only eight weeks (Sparkman, Briley, & Gillham, 1984) up to three years (Cotterchio et al., 1998; Kneller & Bierma, 1990). A reason cited for temporary effect of training is that it is hard to change peoples' attitudes and behavior in a permanent way if it is not continually reinforced. Educational training can increase knowledge and change attitudes concerning food safety but it does not always have the intended effect. General classroom training might only have minimal effects on knowledge.

Training can also improve health inspection scores. Scores were found to be higher (better) in establishments where employees had been recently trained in food safety. A study by Kassa et al. (2010) states that there were fewer critical violations (CVs) in facilities with certified workers (1.75 CVs) than those without certified workers (2.05 CVs) ( $p$ -value = 0.040). However, the authors reported that the same establishments with fewer critical violations also had higher non-critical violations. This could be because the critical violations were given more priority and the non-critical issues were given less attention. It also could have been because not

all inspections are conducted in the same way and if fewer critical violations are found then more non-critical violations will be addressed in the health inspection report. Common sense would suggest that an increase in health inspection scores, less critical violations, would mean an overall improvement in food safety and hygiene throughout an establishment.

Other food safety research papers have also reported that training could result in higher health inspection scores. A review by Egan et al. (2006) shows that four out of five studies had some or significant improvement in inspection scores while one found no significant improvement. Cotterchio, Gunn, Coffill, Tormey, and Barry (1998) reported mean inspection scores for restaurants improved significantly one year after a training intervention. The control group did not have a significant change after one year. They noted that the improvement in inspection scores could have been due to the training intervention. Hammond, Brooks, Schlottman, Johnson, and Johnson (2005) stated that in a Canadian study, inspection scores improved shortly after training but scores were no different than the post-training scores six months after the training. On the other hand, Burke, Manes, Liu, and Dworkin (2014) found a non-significant relationship between a higher inspection score and knowledge test score of a certified food manager that was employed by the restaurant. Generally in literature there is inconclusive evidence that food safety training improves food safety knowledge or inspection scores.

Food safety certification is standardized training programs in which participants are documented as food safety certified (Almanza, 2004). Certification training can range from as short as two hours or can last over the course of a few days. In the 1980s, San Diego County in California mandated that almost all food service workers become certified in food safety. The county health department noticed an evident decrease in food borne illnesses in restaurants. A

study was conducted in San Diego County from 2003-2008 that surveyed 1,200 workers about food safety. The same workers were re-surveyed five years later and violations decreased by 60% and food safety knowledge had increased by 50%. The county health department found that having a certified kitchen manager was important in these results (Burkett, 2010). In another study, Lynch et al. (2003) found significant differences in mean test scores between certified (89) versus non-certified (82.8) participants ( $p\text{-value} = 0.0034$ ). In 2010, California followed San Diego County in its mandate that all food safety workers are certified (Coleman et al., 2013).

The certification requirements vary from state to state as shown in Table 1. More than half the states, 32 in number, do not have any certification requirements for either managers or food handlers. Most states do require the person in charge to demonstrate knowledge of food safety; one option is to be certified in an approved course (Food Marketing Institute, 2014). In Ohio, it is mandatory for one person per shift to have level one certification under the following conditions: 1) if a new food service operation or new retail food establishment was licensed after March 1, 2010; 2) if the operation has been implicated in a foodborne disease outbreak or, 3) if the establishment has failed to maintain sanitary conditions as determined by the local health department (ODH, 2010a).

Table 1

*State Requirements - Food Safety Certification*

Managers	Handlers	Both	Neither
AL, IL, NV, IN, MS, MN, SD, FL, LA, NY, OH, RI	AK, CA, WA	UT, OR	AZ, MD, MI, MT, NE, OK, AR, KS, CO, GA, ID, PA, TN, WV, WI, WY, ME, MA, NH, TX, IA, KY, ND, SC, VT, NM, DE, CT, HI, NJ, NC, VA

Source: TrainandCert.com, 2011

**Limitations of Food Safety Training Studies**

Many studies on the relationship between food safety training and the prevention of FBI stated limitations to their work. These limitations resulted from the different parameters the studies used to evaluate the effectiveness of the training. Some used a combination of audits, observations and questionnaires (Rowell et al., 2013), interviews of food safety workers (Burke et al., 2014), inspection records and reports (Cotterchio et al., 1998; Kassa et al., 2010), or questionnaires focused on behavior (Pilling et al., 2008). Others evaluated contributing factors associated with foodborne illness outbreaks such as improper cooking and holding temperatures, contamination, and poor personal hygiene (Hammond, Brooks, Schlottman, Johnson, & Johnson 2005). Each of these methods had its own limitations, but it was difficult to compare the studies because of the diverse methods. Some authors reported limitations including bias on the part of health inspectors, or differences in institutional (schools or prisons) versus chain restaurants (Burke et al., 2014; Cotterchio et al., 1998; Egan et al., 2006; Hammond et al., 2005).

The studies were aimed to evaluate food safety training, which primarily included both knowledge and behavioral issues. A worker or employee tasked with food preparation, cooking, serving, transporting, or managing other workers must first have the knowledge of correct food safety procedures and also understand why it is important, and then actually perform the needed action to comply with proper food safety. So a limitation to evaluating food safety training was if one of these components was not included.

**Public Health - Dayton and Montgomery County Food Safety Training**

In March 2001, the Ohio Uniform Food Safety Code, based on the 1999 Food and Drug Administration's (FDA) Model Food Code, was updated. This new 2001 Ohio code required a person in charge (PIC) at a food service operation or a retail food establishment to demonstrate

knowledge of foodborne disease prevention and food safety during an inspection. This could involve having no violations, answering the health inspector's questions correctly or being certified by an approved food safety certification class (ODH, 2010a).

In January 2010, ODH changed rule 3701-21-25 of the OAC to allow two different levels of certification for food employees (ODH, 2010a). Level Two certification, a more extensive program for manager certification, has been in place since 1973. Level One, however, is a basic food handler training including state-standard minimum curriculum. The level one training includes topics such as time and temperature relationships (proper cooking, cooling and holding temperatures), personal hygiene and hand washing, cross contamination, cleaning/sanitizing of equipment and utensils and approved food sources, among others. One or more participants from an establishment with one of the mandatory cases discussed earlier would be required to take a level-one certification class. All participants who complete the course receive a certificate of completion that is valid throughout the state of Ohio. From 2011 through early 2014, over one thousand people have taken the course through PHDMC (J. Wentzel, personal communication, May 28, 2014; ODH, 2010b).

PHDMC's Level One Certification in Food Protection was approved by ODH on May 5, 2010 and beginning in March 2011 PHDMC started offering the course (J. Wentzel, personal communication, June 27, 2014). This course comprises of didactic session of two hours in which concepts regarding food handling and storage, temperatures and sanitization are explained. Although not mandatory, PHDMC included a quiz portion to the course. The same quiz was taken by each participant twice, before the training and after completion. This was added as a measure to determine if the training was effective. The quiz consists of ten multiple-choice questions including basic food safety knowledge such as hand washing, proper holding and



reheating temperatures, sanitization, cross contamination and thawing. The quiz scores are solely for health department use and do not impact the participant's certification (A. Pierce, personal communication, January 3, 2014).

### **Methods**

Approval was obtained to use the quiz data from the Level One Food Safety Certification Training by PHDMC (Appendix 5). This research has been approved by both the Wright State University Institution Review Board (Appendix 1) and PHDMC's Research Review Panel (Appendix 2). Both before and after completing PHDMC's Level One Food Safety Certification training, each trainee was asked, but not required, to complete a ten-question quiz (Appendix 6). Information on each completed quiz included the name of the student, date of training, instructor's name, answers to the pre and post quiz, and the primary responsibility of the trainee in food service. There were ten questions on the quiz including topics regarding hand washing, temperatures, food storage, etc.

For the current analysis, pre- and post-quiz data from 692 participants in 2011, 2012 and 2013 were collected and entered into an Excel spreadsheet and transferred to IBM SPSS (IBM Corp., 2012). Pre- and post-quiz scores were entered for each of the ten questions, using a (1) as a correct answer and a (0) as an incorrect answer. Using SPSS, paired t-tests were used to analyze the pre- and post-quiz scores (%) and the change in pre- to post-quiz scores for each student. The change in pre to post scores was analyzed to see if the training course was effective in changing the knowledge of the participant during the course. The change in scores for individual questions was analyzed to see if certain questions were missed more than others. Primary responsibilities of the food service worker were analyzed to assess relationship among quiz scores and job duties, e.g., if there is a difference in quiz scores between managers and cooks. A two-sided p-value of  $<0.05$  was considered significant.

Almost 100% of 2011 and 2013 quizzes and about half of 2012 quizzes were utilized for the analysis. Some quizzes were excluded due to missing or illegible information. The quiz has been the same throughout the three-year history of the course with the exception of the addition of the job responsibilities question at the end which was added in April 2012.

### Data Analysis and Results

Quiz data was recorded from 692 participants. There were 506 participants that answered all pre and post questions yielding a complete data set. The percentage of completed quizzes out of the total collected was 73% (506/692). A copy of PHDMC's Level One Food Certification quiz questions and answer options are shown in Table 2 and as appendix F.

Table 2

*Public Health- Dayton & Montgomery County's Level One Food Certification Training Quiz*

	Question	Answer Options
1	People get sick from food because of	a) Improper food temperatures; b) Contaminating cooked foods by raw products, dirty equipment, utensils, or cutting boards; c) Failing to wash hands; d) All of the above
2	Foods must be rapidly reheated to at least:	a)140°F; b)165°F; c)120°F; d)212°F
3	What minimum temperature should hot time-temperature controlled for safety foods be held at?	a) 135°F; b)155°F; c)165°F; d)130°F
4	The safest way to thaw foods properly is:	a) In the steam table; b) In a pot of warm water; c) On the counter at room temperature; d) In the refrigerator
5	In order to make sure your metal stem thermometer is working correctly, you need to:	a) Thermometers never need to be calibrated; b) Immersing in the steam table water and adjusting it until it reads 180°F; c) Leave out on the counter and adjust to equal room air temperature; d) Placing it in a crushed ice water bath and adjusting it until it reads 32°F
6	Which of the following is not a way to prevent cross contamination?	a) Store raw food below and/or away from cooked food; b) Use separate utensils and cutting boards for raw and cooked foods; c) Wash hands before and after purchasing raw food and before touching cooked food; d) Leave raw food uncovered in walk-in cooler

Table 2 (Cont'd)

*Public Health- Dayton & Montgomery County's Level One Food Certification Training Quiz*

Question	Answer Options
7 Which scenario represents proper hand washing techniques?	a) Wash in the food prep sink with soap and warm water for 20 seconds, dry hands with common cloth; b) Wash in a designated handsink with soap and warm water for 20 seconds, dry with a paper towel; c) Use handsanitizer at designated handsink after handling raw/cooked foods and switching tasks; d) Wash hands in the wiping cloth bucket of sanitizer in between tasks
8 The proper set up for a three-compartment sink is:	a) Pre-scrape, wash, sanitize, rinse, air dry; b) Pre-scrape, rinse, sanitize, wash, towel dry; c) Pre-scrape, wash, rinse, sanitize, air dry; d) Pre-scrape, rinse, sanitize, wash, towel dry
9 The temperature danger zone is a temperature range between ____ where bacteria reproduce rapidly:	a) 45°F-145°F; b) 41°F-135°F; 45°F-165°F;
10 To cool down hot foods properly:	a) Leave out at room temperature for 1 hour, then cover; b) Remove from hot stove, leave on counter overnight; c) Cool small batches rapidly in shallow pans in a cooler or freezer; d) Transfer to a large pot, cover then place in cooler

The aggregate results are summarized in Table 3, which show that scores improved from pre to post quiz. The mean pre- and post-quiz scores was 7.56 (75.6%), and 9.62 (96.2%), respectively. The average improvement was 2.06 points (20.6%) (p-value < 0.001).

Table 3

*Aggregate Score on Pre Test and Post Test (2011-2013)*

Characteristic	Mean ± SD*
Participants	506
Pre-test score	7.56 ± 1.57
Post test score	9.62 ± 0.76
Improvement in score	2.06 ± 1.52
P-value	<0.001

Note. \* = Standard Deviation

Table 4 shows the pre- and post-quiz data broken down by question. The questions that demonstrated improvement after the class were question two, three, five, nine and ten. With the exception of question five, which dealt with the calibration of a metal-stem thermometer, all the questions with the most improvement were associated with temperature. Question three, which assessed minimum holding temperature for time/temperature controlled for safety (TCS) foods, or potentially hazardous foods, showed the most significant improvement.

Table 5 shows change in pre to post test in scores by each individual question. The improvement was significant for all questions ( $p\text{-value} < 0.001$ ) except for question one ( $p\text{-value}: 0.08$ ) which was not significant. Question three, "Minimum hold temperature for TCS foods," had the highest improvement with a mean change in score of 0.49 with question ten being a close second with a mean change in score of 0.41. Question one, "People get sick from food because of," had the lowest improvement with a mean change of 0.01 points.

Table 4

*Individual Scores on Pre Test and Post Test (2011-2013)*

<b>Question</b>	<b>Total</b>	<b>Wrong Pre &amp; Right Post</b>	<b>Wrong Pre &amp; Wrong Post</b>	<b>Right Pre &amp; Wrong Post</b>	<b>Right Pre &amp; Right Post</b>
	N	N (%)	N (%)	N (%)	N (%)
Question 1: People get sick from food because of:	536	9 (1.7)	2 (0.4)	3 (0.6)	522 (97.4)
Question 2: Foods must be rapidly reheated to at least:	547	156 (28.5)	4 (0.7)	1 (0.2)	386 (70.6)
Question 3: What minimum temperature should hot time-temperature controlled for safety foods be held at?	556	280 (50.4)	64 (11.5)	6 (1.1)	206 (37.1)
Question 4: The safest way to thaw foods properly is:	538	50 (9.3)	5 (0.9)	3 (0.6)	480 (89.2)
Question 5: In order to make sure your metal-stem thermometer is working correctly, you need to:	540	173 (32.0)	8 (1.5)	2 (0.4)	357 (66.1)
Question 6: Which of the following is not a way to prevent cross contamination?	532	50 (9.4)	21 (3.9)	5 (0.9)	456 (85.7)
Question 7: Which scenario represents proper hand washing techniques?	532	21 (3.9)	1 (0.2)	3 (0.6)	507 (95.3)
Question 8: The proper set up for a three-compartment sink is:	540	73 (13.5)	11 (2.0)	2 (0.4)	454 (84.1)
Question 9: The temperature danger zone is a temperature range between ___ where bacteria reproduce rapidly:	541	196 (36.2)	29 (5.4)	7 (1.3)	309 (57.1)
Question 10: To cool down hot foods properly:	545	224 (41.1)	30 (5.5)	1 (0.2)	290 (53.2)

Table 5

*Pre-test and Post test Scores on Individual Test Questions (2011-2013)*

Question	Total N	Pre-test Score Mean	Post-test Score Mean	Change in Score	p-value
		Mean $\pm$ SD*	Mean $\pm$ SD*	Mean $\pm$ SD*	
Question 1: People get sick from food because of:	536	0.98 $\pm$ 0.14	0.99 $\pm$ 0.10	0.01 $\pm$ 0.15	0.080
Question 2: Foods must be rapidly reheated to at least:	547	0.71 $\pm$ 0.46	0.99 $\pm$ 0.10	0.28 $\pm$ 0.46	<0.001
Question 3: What minimum temperature should hot time-temperature controlled for safety foods be held at?	556	0.38 $\pm$ 0.49	0.87 $\pm$ 0.33	0.49 $\pm$ 0.52	<0.001
Question 4: The safest way to thaw foods properly is:	538	0.90 $\pm$ 0.30	0.99 $\pm$ 0.12	0.09 $\pm$ 0.30	<0.001
Question 5: In order to make sure your metal-stem thermometer is working correctly, you need to:	540	0.66 $\pm$ 0.47	0.98 $\pm$ 0.13	0.32 $\pm$ 0.47	<0.001
Question 6: Which of the following is not a way to prevent cross contamination?	532	0.87 $\pm$ 0.34	0.95 $\pm$ 0.22	0.08 $\pm$ 0.31	<0.001
Question 7: Which scenario represents proper hand washing techniques?	532	0.96 $\pm$ 0.20	0.99 $\pm$ 0.09	0.03 $\pm$ 0.21	<0.001
Question 8: The proper set up for a three-compartment sink is:	540	0.84 $\pm$ 0.36	0.98 $\pm$ 0.15	0.13 $\pm$ 0.35	<0.001
Question 9: The temperature danger zone is a temperature range between ___ where bacteria reproduce rapidly:	541	0.58 $\pm$ 0.49	0.93 $\pm$ 0.25	0.35 $\pm$ 0.50	<0.001
Question 10: To cool down hot foods properly:	545	0.53 $\pm$ 0.50	0.94 $\pm$ 0.23	0.41 $\pm$ 0.50	<0.001

Note. \* = Standard Deviation

A total of 150 people submitted information about their primary job responsibility at the end of the quiz. Mean pre and post scores of these 150 participants were compared to job responsibility (Table 6). Scores were fairly similar across the categories. Food establishment owners had the highest score on the pre quiz (8.2) but it was not statistically significant (p-value: 0.109). Food servers scored the highest on the post quiz (9.69) and also showed the highest improvement from pre to post quiz (2.00) (p-value: <0.001).

Table 6

*Aggregate Test Scores by Job Responsibility (2011-2013)*

<b>Job Responsibility</b>	<b>N</b>	<b>Pre Score Mean <math>\pm</math> SD</b>	<b>Post Score Mean <math>\pm</math> SD</b>	<b>Mean Difference <math>\pm</math> SD</b>	<b>Sig (2-tailed)</b>
Manager	50	7.94 $\pm$ 1.59	9.66 $\pm$ 0.63	1.72 $\pm$ 1.55	<0.001
Owner	05	8.20 $\pm$ 1.30	9.40 $\pm$ 0.89	1.20 $\pm$ 1.30	0.109
Preparation	50	7.74 $\pm$ 1.41	9.58 $\pm$ 0.95	1.84 $\pm$ 1.39	<0.001
Cook	29	7.31 $\pm$ 1.69	9.24 $\pm$ 0.91	1.93 $\pm$ 1.57	<0.001
Server	16	7.69 $\pm$ 1.40	9.69 $\pm$ 0.70	2.00 $\pm$ 1.26	<0.001

Note. \* = Standard Deviation

**Discussion**

The aim of this analysis was to assess the effectiveness of PHDMC's Level One Food Safety Certification program using pre- and post-quiz training data. Even though the mean pre score was fairly high (75.7%), the results show significant improvement, an average of 20.6%, after training. Although the course is open to the public, the vast majority of the participants are from the food service industry, with adequate food safety knowledge, which could have led to high mean pre quiz scores. These results are similar to others. A study in Chicago found an increase in knowledge (6% points) on a 40 question test after passing out educational literature to food handlers (Dworkin, Panchal, & Liu, 2012). This test had similar questions compared to PHDMC's quiz. Also Lilliquist, McCabe, and Church (2005) studied test scores based on 20

questions. Those with no training had a mean test score of 8.0 (40%), those with training had a mean score of 12.4 (62%) and those that had both training and participatory demonstration had a mean score of 15.8 (79%). These results seem to support that food safety training does increase knowledge. If PHDMC were to incorporate a 'hands-on' demonstration this might lead to even higher knowledge gain and quiz scores. No other studies were found for comparison.

When looking at each question individually, four out of the five most missed questions (#2, 3, 9 & 10) were temperature related. Questions two, three, and nine were direct temperature questions and question ten was about proper requirements of time and temperature as food cools. This indicates a need to concentrate more on temperatures and temperature issues during the food safety course or during the education process during inspections. An effort was made to find certification exam scores of Servsafe (National Restaurant Association, n.d.), a nationwide certification provider, but they would not be released. Comparisons of other certification exam scores would be helpful to see if these results are similar and understand what changes should be made, if any.

An advantage of this study was the large data set that was available for analysis. A total of 692 quizzes were entered into the database out of about 850 participants across three years. And most of the quizzes entered were able to be used in the analyses with the exception of the job responsibility data.

### **Limitations**

There were some limitations of this study. One limitation was that although the same presentation slides are used during the class, a number of different sanitarians teach the course including the author of this study. Since the teaching style varies from one sanitarian to another this may somewhat alter the way the information is presented, possibly skewing the quiz results.



Also this analysis does not assess long-term knowledge retention. The post quiz is taken only minutes after the class and participants are not asked to take the quiz again at a later date. The questions do not cover all aspects of the training either. The questions were written to only cover some main points of the class.

Another limitation was the small number of participants that provided the job responsibility information. This was not added to the quiz until April 2012. A small proportion of participants answered this question or answered it in a way that could be categorized into a specific job responsibility. One of the most common answers was 'food safety' or 'keeping people safe'. A better description of this question could possibly improve responses which could be tested in the future.

### **Conclusion**

As reported in literature, food safety training leads to significant improvements in knowledge, higher inspection scores and some improvements in behavior. But, the overall consensus of food safety training and how it impacts the real world in terms of FBIs is unclear. There does not seem to be any data supporting the long-term effectiveness of training. Most agree on a few issues including 1) that food safety training is an important factor in combating the risk of FBI, 2) the training has a limited impact and 3) more research is needed to know the true impact (Hammond et al., 2005; Kassa et al., 2010; Rowell et al., 2013; Soares et al., 2013).

According to the Theory of Planned Behavior, in order to change the behavior it is crucial to target persons' attitudes, subjective norms (how other people perceive the issue) and perceptions of control over the issue (Pilling et al., 2008). Proper food safety training should seek to address all of these items including knowledge, attitudes, subjective norms, perceptions of control and behavior. However, assessing the effectiveness would be difficult as those studies

would require a long time and would be intrusive into the establishments being studied. The foodservice industry has a quick turnover time in employees and managers so tracking the same employee over a long period of time might not be possible.

Soon, Baines, and Seaman (2012) stated that an implied assumption of the Theory of Planned Behavior is that any training will change behavior. However, studies have found that people do not put their newly acquired knowledge into practice after receiving training, and if they do it is not for a long period of time (Egan et al., 2006; Pilling et al., 2008; Soon et al., 2012). Training must be targeted, be coupled with communication and be included in a culture of food safety that promotes the wanted behaviors. No studies could be found that showed training was highly effective at changing behavior.

The hallmarks of an effective food safety training program seem to include a number of elements. One is the theoretical or classroom instruction to teach the knowledge that surrounds food safety. It should include the most current best-case practices as mandated by the local and state health departments. It can also include completing a certification program from the health department or other certifier. At least one study found higher test scores of participants that had gone through health department training as opposed to other corporate training (Coleman et al., 2013). Another important element is the practical, hands-on approach, as reported by Lilliquist et al. (2005), where the group with training partnered with a participatory demonstration of hand washing had the best scores. Kassa et al. (2010) reported that the hands-on trained people tested better than those trained in only the theoretical concepts. Continual training over time can engrain these ideas into full practice. To be effective, a combination of approaches to training may be needed.

Restaurants and other food service operations should incorporate food safety into all of its practices and make it the number-one priority. It includes having managers and employees who are trained in food safety and are monitoring the food safety practices constantly. Further monitoring and evaluation is needed of the longer-term benefits and effectiveness of different types of food safety training. Food safety training will continue to be a common approach to preventing foodborne illness in the industry because, in the end, people and their food handling actions have the biggest impact on food safety.

PHDMC's Level One Food Safety Training Certification is effective in increasing knowledge of the participants from pre to post quiz. However, more focus on the temperature-related issues should be incorporated into the class as these were the most missed questions on the quiz. PHDMC should continue to offer this course. Food industry personnel should be encouraged to participate in food safety training and certification as often as necessary to increase and maintain their food safety knowledge.

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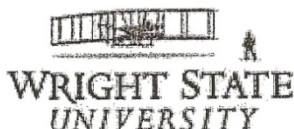
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**Appendix A: Wright State University IRB Approval**

Office of Research and Sponsored Programs  
201J University Hall  
3640 Col. Glenn Hwy.  
Dayton, OH 45435-0001  
(937) 775-2425  
(937) 775-3781 (FAX)  
e-mail: [rsp@wright.edu](mailto:rsp@wright.edu)

**DATE:** February 14, 2014

**TO:** Matthew Tyler, PH, Graduate Student  
School of Medicine  
Naila Khalil, Ph.D., Faculty Advisor

**FROM:** B. Laurel Elder, Chair   
WSU Institutional Review Board

**SUBJECT:** SC# 5420

*'Is PHDMC's Level One Food Safety Certification Training Effective?'*

At the recommendation of the IRB Chair, your study referenced above has been recommended for exemption. Please note that any change in the protocol must be approved by the IRB; otherwise approval is terminated.

This action will be referred to the Full Institutional Review Board for ratification at their next scheduled meeting.

**NOTE:** This approval will automatically terminate two (2) years after the above date unless you submit a "continuing review" request (see [http://www.wright.edu/rsp/IRB/CR\\_sc.doc](http://www.wright.edu/rsp/IRB/CR_sc.doc)) to RSP. You will not receive a notice from the IRB Office.

If you have any questions or require additional information, please call Robyn Wilks, IRB Coordinator at 775-4462.

Thank you!

Enclosure

## RESEARCH INVOLVING HUMAN SUBJECTS

SC# 5420ACTION OF THE WRIGHT STATE UNIVERSITY  
EXPEDITED REVIEW

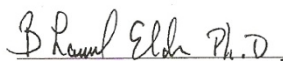
Assurance Number: FWA00002427

Title: 'Is PHDMC's Level One Food Safety Certification Training Effective?'

Principal Investigator: Matthew Tyler, PH, Graduate Student  
School of Medicine  
Naila Khalil, Ph.D., Faculty Advisor

The Institutional Review Board Chair has approved an exemption with regard to the use of human subjects on this proposed project.

REMINDER: Federal regulations require prompt reporting to the IRB of any changes in research activity [changes in approved research during the approval period may not be initiated without IRB review (submission of an amendment), except where necessary to eliminate apparent immediate hazards to subjects] and prompt reporting of any serious or on-going problems, including unanticipated adverse reactions to biologicals, drugs, radioisotope labeled drugs or medical devices.



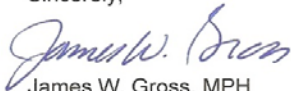


Signed \_\_\_\_\_ Chair, WSU-IRB

Approval Date: February 14, 2014

IRB Mtg. Date: March 17, 2014

## Appendix B: PHDMC Research Review Board Approval Letter

 <b>Public Health</b> Prevent. Promote. Protect.  <b>Reibold Building</b> 117 South Main Street Dayton, Ohio 45422 937-225-4395 Voice 937-496-3070 Fax  <b>Health Commissioner</b> James W. Gross, M.P.H.  <b>Assistant to the Health Commissioner</b> Jeffrey A. Cooper, M.S.  <b>Medical Director</b> Thomas Herchline, M.D.  <b>Board of Health</b> <i>President</i> Patricia S. Meadows, MSSW <i>President Elect</i> Emmett Orr, M.P.A.  Lloyd L. Laubach, Ph.D. Jan Lepore-Jentleson Gary L. LeRoy, M.D. David Page, M.D. John E. Rhodes, D.D.S. J. Michael Sims Ken Spires  <i>Equal Opportunity Employer/Service Provider</i>  	<b>Dayton &amp; Montgomery County</b>  March 17, 2014  Matt Tyler R.S. 3209 Delaney St. Kettering, Oh 45420  Dear Mr. Tyler:  IRB #: 2014.03.17.  Title of Proposal: Is PHDMC's Level One Food Safety Certification Training Effective?  The Public Health-Dayton & Montgomery County (PHDMC) Research Review Panel has reviewed and accepted your research project. You have been approved to conduct this study for one calendar year beginning March 17, 2014. Projects must be conducted in full accordance with the guidelines of Public Health-Dayton & Montgomery County (PHDMC).  Annually, <b>OR</b> when the project is completed, a project report must be submitted. For any research activity which continues beyond one year after the approval start date, project status reports will be requested by the PHDMC Research Review Panel. Any significant change in procedure, research participants, or plans to publish not addressed in the original project application must be reviewed and approved prior to implementation.  A confidentiality agreement must be signed by all research participants prior to the execution of any research activities. This agreement and any other signed documents will be kept by the PHDMC Research Review Panel for at least three years past completion of the research project.  Thank you for considering Public Health-Dayton & Montgomery County as an agency to assist you in your pursuit of scientific exploration. We look forward to working with you.  Sincerely,   James W. Gross, MPH Health Commissioner
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### Appendix C: PHDMC Pledge of Confidentiality



#### Pledge of Confidentiality

1. I will use these data only for the project titled Is PHDMC's Level One Food Safety Certification Training Effective?
2. I will not use these data in any way other than for statistical, scientific or medical research.
3. I will not release or allow access to these data in full or in part to any person without the written permission of PHDMC.
4. Unless it is part of my study or project, I will not attempt to learn the identity of any person or medical care provider beyond the information contained in these data.
5. I will not present or publish these data in a manner in which any individual can be identified.
6. I will not present or publish point maps showing residences of cases.
7. I will not release data for any sub-population of < 10 persons based on the relevant U.S. Census data.
8. I will not attempt to link, or permit others to link, these data to individually identified records in another database, file or other information source without the written permission of PHDMC.
9. In the event that the identity of any person is discovered or released inadvertently:  
I will immediately notify PHDMC of the incident.  
I will make no use of this knowledge.  
I will inform no one else of any discovered identity.
10. I will include the following acknowledgment and disclaimer in any publication or presentation produced from these data: "Public Health - Dayton & Montgomery County data used in this study were obtained from the PHDMC - Environmental Health (program name). Use of these data does not imply PHDMC agrees or disagrees with any presentations, analyses, interpretations or conclusions."
11. I will send a copy of any publication or presentation produced from these data to PHDMC program identified above in a timely manner.
12. I will destroy the data no later than 1 year after PHDMC approval, or an application to extend the date of required destruction of the data must be received by PHDMC no later than 5 working days prior to the 1 year.
13. I will make all reasonable efforts to maintain the confidentiality of these data.

Matthew Tyler  
Print Name

[Signature]  
Signature

2-19-14  
Date



## Appendix D: PHDMC Research Exemption Form



### EXEMPTION FORM

Projects that do not meet the definition of research and/or human subject, as well as certain categories of research involving human subjects, do not fall under the IRB purview or are exempt from IRB review. Please mark the relevant category or categories for which you are requesting an exemption determination. **Please attach this document to your Petition of Approval of Research Involving Human Subjects.**

#### Projects that do not meet the definition of research involving human subjects under 45 CFR 46.102:

<input type="checkbox"/>	IRB review of the project is not required because it does not meet the definition of <u>research</u> in 45 CFR 46.102(d) which defines 'research' as "a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge." Examples of projects that may not be research include quality improvement programs or required program evaluations that will not be published or disseminated formally.
<input type="checkbox"/>	IRB review of the project is not required because it does not involve <u>human subjects</u> as recognized by 45 CFR 46.102(f) which defines a 'human subject' as "a living individual about whom an investigator (whether professional or student) conducting research obtains (1) data through intervention or interaction with the individual, or (2) identifiable private information."

If you have checked either of the previous two boxes, your research does NOT have to be submitted for IRB approval. If your research does meet the definition of research involving human subjects and you feel it meets the criteria for exemption, please mark the appropriate category and submit this with your Petition of Approval.

#### Projects involving human subjects research activities in exemption categories allowed under 45 CFR 46.101:

<input type="checkbox"/>	(1) Research conducted in established or commonly accepted educational settings, involving normal educational practices, such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.
<input type="checkbox"/>	(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.  ***Note: interview or survey research involving children does not qualify for exemption.***
<input type="checkbox"/>	(3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section, if (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) Federal statute(s) require(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.
<input checked="" type="checkbox"/>	(4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.
<input type="checkbox"/>	(5) Research and demonstration projects which are conducted by or subject to the approval of [Federal] Department or Agency heads, and which are designed to study, evaluate, or otherwise examine: (i) Public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.
<input type="checkbox"/>	(6) Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the Food and Drug Administration or approved by the Environmental Protection Agency or the Food Safety and Inspection Service of the U.S. Department of Agriculture.

## Appendix E: PHDMC Letter of approval



**Public Health**  
Prevent. Promote. Protect.

**Dayton &  
Montgomery  
County**

**Reibold Building**  
117 South Main Street  
Dayton, Ohio 45422  
937-225-4443 Voice  
937-496-3072 Fax

**Health Commissioner**  
James W. Gross, M.P.H.

**Assistant to the  
Health Commissioner**  
Jeffrey A. Cooper, M.S.

**Medical Director**  
Thomas Herchline, M.D.

**Director  
of Environmental Health**  
Mark A. Case, R.S., M.S.A.

**Board of Health**

*President*  
Patricia S. Meadows, MSSW

*President Elect*  
Emmett Orr, M.P.A.

Lloyd L. Laubach, Ph.D.

Jan Lepore-Jentleson

Gary L. LeRoy, M.D.

David Page, M.D.

John E. Rhodes, D.D.S.

J. Michael Sims

Ken Spires

*Equal Opportunity  
Employer/Service Provider*



December 18, 2013

Matt Tyler R.S.  
117 South Main St.  
Dayton, Ohio 45422

Re: Data Request

Mr. Tyler,

I am writing to give approval for your use of the agency's Level One Food Safety Class quiz data. It is understood that this data set will be used for analysis in your culminating experience project. All personal identifiers will be removed from the quiz data prior to your access.

We expect that any results and conclusions will be shared with PHDMC when completed.

Sincerely,

*Alan Pierce MPH, RS*

Alan Pierce, MPH, RS  
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**Appendix F: PHDMC Level 1 Food Safety Certification Quiz**

Public Health- Dayton & Montgomery County

Level One Certification in Food Protection

Pre and Post Survey

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Instructor: \_\_\_\_\_

Pre \_\_\_\_ Post \_\_\_\_

1. People get sick from food because of:

- a) Improper food temperatures
- b) Contaminating cooked foods by raw products, dirty equipment, utensils, or cutting boards
- c) Failing to wash hands
- d) All of the above

Pre \_\_\_\_ Post \_\_\_\_

2. Foods must be rapidly reheated to at least:

- a) 140°F
- b) 165°F
- c) 120°F
- d) 212°F

Pre \_\_\_\_ Post \_\_\_\_

3. What minimum temperature should hot time-temperature controlled for safety foods be held at:

- a) 135°F
- b) 155°F
- c) 165°F
- d) 130°F

Pre \_\_\_\_ Post \_\_\_\_

4. The safest way to thaw foods properly is:

- a) In the steam table
- b) In a pot of warm water
- c) On the counter at room temperature
- d) In the refrigerator

Pre \_\_\_\_ Post \_\_\_\_

5. In order to make sure your metal stem thermometer is working correctly, you need to calibrate it by:

- a) Thermometers never need to be calibrated
- b) Immersing in the steam table water and adjusting it until it reads 180°F
- c) Leave out on the counter and adjust to equal room air temperature
- d) Placing it in a crushed ice water bath and adjusting it until it reads 32°F



- Pre \_\_\_\_ Post \_\_\_\_ 6. Which of the following is not a way to prevent cross contamination:
- a) Store raw food below and/or away from cooked food
  - b) Use separate utensils and cutting boards for raw and cooked foods
  - c) Wash hands before and after touching raw food and before touching cooked food
  - d) Leave raw food uncovered in walk in cooler
- Pre \_\_\_\_ Post \_\_\_\_ 7. Which scenario represents proper hand washing techniques:
- a) Wash in the food prep sink with soap and warm water for 20 seconds, dry hands with common cloth
  - b) Wash in a designated hand sink with soap and warm water for 20 seconds, dry with a paper towel
  - c) Use hand sanitizer at designated hand sink after handling raw/cooked foods and switching tasks
  - d) Wash hands in the wiping cloth bucked of sanitizer in between tasks
- Pre \_\_\_\_ Post \_\_\_\_ 8. The proper set up for a three-compartment sink is
- a) Pre-scrape, wash, sanitize, rinse, air dry
  - b) Pre-scrape, rinse, sanitize, wash, towel dry
  - c) Pre-scrape, wash, rinse, sanitize, air dry
  - d) Pre-scrape, rinse, sanitize, wash, towel dry
- Pre \_\_\_\_ Post \_\_\_\_ 9. The temperature danger zone is a temperature range between \_\_\_\_ where bacteria reproduce rapidly:
- a) 45°F-145°F
  - b) 41°F-135°F
  - c) 45°F-165°F
  - d) 40°F-165°F
- Pre \_\_\_\_ Post \_\_\_\_ 10. To cool down hot foods properly:
- a) Leave out at room temperature for 1 hour, then cover
  - b) Remove from hot stove, leave on counter overnight
  - c) Cool small batches rapidly in shallow pans in a cooler or freezer
  - d) Transfer to a large pot, cover then place in cooler

What are your primary job responsibilities in food service? \_\_\_\_\_

## Appendix G: List of Competencies Used in CE

### Tier 1 Core Public Health Competencies

Domain #1: Analytic/Assessment
Use variables that measure public health conditions
Use methods and instruments for collecting valid and reliable quantitative and qualitative data
Identify sources of public health data and information
Recognize the integrity and comparability of data
Identify gaps in data sources
Adhere to ethical principles in the collection, maintenance, use, and dissemination of data and information
Describe the public health applications of quantitative and qualitative data
Collect quantitative and qualitative community data (e.g., risks and benefits to the community, health and resource needs)
Use information technology to collect, store, and retrieve data
Describe how data are used to address scientific, political, ethical, and social public health issues
Domain #2: Policy Development and Program Planning
Identify mechanisms to monitor and evaluate programs for their effectiveness and quality
Domain #3: Communication
Communicate in writing and orally, in person, and through electronic means, with linguistic and cultural proficiency
Participate in the development of demographic, statistical, programmatic and scientific presentations
Domain #4: Cultural Competency
N/A
Domain #5: Community Dimensions of Practice
N/A
Domain #6: Public Health Sciences
Describe the scientific foundation of the field of public health
Describe the scientific evidence related to a public health issue, concern, or, intervention
Retrieve scientific evidence from a variety of text and electronic sources
Discuss the limitations of research findings (e.g., limitations of data sources, importance of observations and interrelationships)
Domain #7: Financial Planning and Management
Describe the local, state, and federal public health and health care systems
Domain #8: Leadership and Systems Thinking
N/A

### Concentration Competencies

Emergency Preparedness:
Demonstrate the mastery of the use of principles of crisis and risk management
Use research and/or evaluation science methodologies and instruments to collect, analyze and interpret quantitative and qualitative data
Demonstrate an understanding of the protection of worker health and safety